

conjunction with a genetic vaccine. The choice of vector and components can also be optimized for the particular purpose of treating allergy or other conditions. In one aspect, the optimized genetic vaccine components are used in conjunction with other optimized genetic vaccine reagents. For example, an antigen that is useful for a particular condition can be optimized by methods analogous to the reassembly (&/or one or more additional directed evolution methods described herein) and screening methods described herein.

The polynucleotide that encodes the recombinant antigenic polypeptide can be placed under the control of a promoter, e.g., a high activity or tissue-specific promoter. The promoter used to express the antigenic polypeptide can itself be optimized using reassembly (&/or one or more additional directed evolution methods described herein) and selection methods analogous to those described herein., as described in International Application No. PCT/US97/17300 (International Publication No. WO 98/13487).

The vector can contain immunostimulatory sequences such as are described herein. A vector engineered to direct a  $T_H1$  response can be used for many of the immune responses mediated by the antigens described herein. The reagents obtained using the methods of the invention can also be used in conjunction with multicomponent genetic vaccines, which are capable of tailoring an immune response as is most appropriate to achieve a desired effect. It is sometimes advantageous to employ a genetic vaccine that is targeted for a particular target cell type (e.g., an antigen presenting cell or an antigen processing cell); suitable targeting methods are described herein.

#### Delivery of genetic vaccines and delivery vehicles to mammals *in vivo* and *ex vivo*

Genetic vaccines, (e.g. genetic vaccines that include the optimized experimentally generated polynucleotides obtained as described herein, such as genetic vaccines that encode the multivalent antigens described herein, including the multicomponent genetic vaccines described herein), can be delivered to a mammal (including humans) to induce a therapeutic or prophylactic immune response. Vaccine delivery vehicles can be delivered *in vivo* by administration to an individual patient, typically by systemic administration (e.g., intravenous, intraperitoneal, intramuscular, subdermal, intracranial, anal, vaginal, oral, buccal route or they can be inhaled) or they can be administered by topical application.

Alternatively, vectors can be delivered to cells *ex vivo*, such as cells explanted from an individual patient (e.g., lymphocytes, bone marrow aspirates, tissue biopsy) or universal

donor hematopoietic stem cells, followed by reimplantation of the cells into a patient, usually after selection for cells which have incorporated the vector.

#### **Delivery methods and references**

A large number of delivery methods are well known to those of skill in the art. Such methods include, for example liposome-based gene delivery (Debs and Zhu (1993) WO 93/24640; Mannino and Gould-Fogerite (1988) BioTechniques 6(7): 682- 691; Rose U.S. Pat No. 5,279,833; Brigham (1991) WO 91/06309; and Felgner et al. (1987) Proc. Natl. Acad. Sci. USA 84: 7413-7414), as well as use of viral vectors (e.g., adenoviral (see, e.g., Berns et al. (1995) Ann. NY Acad Sci. 772: 95-104; Ali et al. (1994) Gene Ther. 1: 367-3 84; and Haddada et al. (1995) Curr. Top. Microbiol. Immunol. 199 (Pt 3): 297- 306 for review), papillomaviral, retroviral (see, e.g., Buchscher et al. (1992) J Virol. 66(5) 2731-2739; Johann et al. (1992) J Virol. 66 (5):163 5-1640 (1992); Sommerfelt et al. , (1990) Virol. 176:58-59; Wilson et al. (1989) J Virol. 63:2374-2378; Miller et al., J Virol. 65:2220-2224 (1991); Wong-Staal et al., PCT/US94/05700, and Rosenberg and Fauci (1993) in Fundamental Immunology, Third Edition, Paul (ed) Raven Press, Ltd., New York and the references therein, and Yu et al., Gene Therapy (1994) supra.), and adeno-associated viral vectors (see, West et al. (1987) Virology 160:3 8-47; Carter et al. (1989) U. S. Patent No. 4,797,3 68; Carter et al. WO 93/24641 (1993); Kotin (1994) Human Gene Therapy 5:793 - 801; Muzyczka (1994) J Clin. Invest. 94:1351 and Samulski (supra) for an overview of AAV vectors; see also, Lebkowski, U.S. Pat. No. 5,173,414; Tratschin et al. (1985) Mol. Cell. Biol. 5(11):3251-3260; Tratschin, et al. (1984) Mol. Cell. Biol., 4:2072- 2081; Hermonat and Muzyczka (1984) Proc. Natl. Acad Sci. USA, 81:6466-6470; McLaughlin et al. (1988) and Samulski et al. (1989) J Virol., 63:03 822-3 828), and the like.

Introduction of "Naked" DNA and/or RNA that comprises a genetic vaccine directly into a tissue or using "biolistic" or particle-mediated transformation, both *in vivo* and *ex vivo*

"Naked" DNA and/or RNA that comprises a genetic vaccine can be introduced directly into a tissue, such as muscle. See, e.g., USPN 5,580, 859. Other methods such as "biolistic" or particle-mediated transformation (see, e.g., Sanford et al., USPN 4,945,050; USPN 5,036,006) are also suitable for introduction of genetic vaccines into cells of a mammal according to the invention. These methods are useful not only for *in vivo* introduction of DNA into a mammal, but also for *ex vivo* modification of cells for reintroduction into a mammal. As for other methods of delivering genetic vaccines, if

necessary, vaccine administration is repeated in order to maintain the desired level of immunomodulation.

### SUMMARY OF TABLES 1-85

These tables show preferred, but non-limiting, examples of 3-base long mutagenic cassettes that are non-stochastic and degenerate.

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Table #	Triplet Sequence	Site 1	Site 2	Site 3
1.	N,N,G/T	N	N	G/T
2.	N,N,G/C	N	N	G/C
3.	N,N,G/A	N	N	G/A
4.	N,N,A/C	N	N	A/C
5.	N,N,A/T	N	N	A/T
6.	N,N,C/T	N	N	C/T
7.	N,N,N	N	N	N
8.	N,N,G	N	N	G
9.	N,N,A	N	N	A
10.	N,N,C	N	N	C
11.	N,N,T	N	N	T
12.	N,N,C/G/T	N	N	C/G/T
13.	N,N,A/G/T	N	N	A/G/T
14.	N,N,A/C/T	N	N	A/C/T
15.	N,N,A/C/G	N	N	A/C/G
16.	N,A,A	N	A	A
17.	N,A,C	N	A	C
18.	N,A,G	N	A	G
19.	N,A,T	N	A	T
20.	N,C,A	N	C	A
21.	N,C,C	N	C	C
22.	N,C,G	N	C	G
23.	N,C,T	N	C	T
24.	N,G,A	N	G	A
25.	N,G,C	N	G	C
26.	N,G,G	N	G	G
27.	N,G,T	N	G	T
28.	N,T,A	N	T	A
29.	N,T,C	N	T	C
30.	N,T,G	N	T	G
31.	N,T,T	N	T	T
32.	N,A/C,A	N	A/C	A
33.	N,A/G,A	N	A/G	A
34.	N,A/T,A	N	A/T	A
35.	N,C/G,A	N	C/G	A
36.	N,C/T,A	N	C/T	A
37.	N,T/G,A	N	T/G	A
38.	N,C/G/T,A	N	C/G/T	A
39.	N,A/G/T,A	N	A/G/T	A
40.	N,A/C/T,A	N	A/C/T	A
41.	N,A/C/G,A	N	A/C/G	A
42.	A,N,N	A	N	N

Table #	Triplet Sequence	Site 1	Site 2	Site 3
43.	C,N,N	C	N	N
44.	G,N,N	G	N	N
45.	T,N,N	T	N	N
46.	A/C,N,N	A/C	N	N
47.	A/G,N,N	A/G	N	N
48.	A/T,N,N	A/T	N	N
49.	C/G,N,N	C/G	N	N
50.	C/T,N,N	C/T	N	N
51.	G/T,N,N	G/T	N	N
52.	N,A,N	N	A	N
53.	N,C,N	N	C	N
54.	N,G,N	N	G	N
55.	N,T,N	N	T	N
56.	N,A/C,N	N	A/C	N
57.	N,A/G,N	N	A/G	N
58.	N,A/T,N	N	A/T	N
59.	N,C/G,N	N	C/G	N
60.	N,C/T,N	N	C/T	N
61.	N,G/T,N	N	G/T	N
62.	N,A/C/G,N	N	A/C/G	N
63.	N,A/C/T,N	N	A/C/T	N
64.	N,A/G/T,N	N	A/G/T	N
65.	N,C/G/T,N	N	C/G/T	N
66.	C,C,N	C	C	N
67.	G,G,N	G	G	N
68.	G,C,N	G	C	N
69.	G,T,N	G	T	N
70.	C,G,N	C	G	N
71.	C,T,N	C	T	N
72.	T,C,N	T	C	N
73.	A,C,N	A	C	N
74.	G,A,N	G	A	N
75.	A,T,N	A	T	N
76.	C,A,N	C	A	N
77.	T,T,N	T	T	N
78.	A,A,N	A	A	N
79.	T,A,N	T	A	N
80.	T,G,N	T	G	N
81.	A,G,N	A	G	N
82.	G/C,G,N	G/C	G	N
83.	G/C,C,N	G/C	C	N
84.	G/C,A,N	G/C	A	N
85.	G/C,T,N	G/C	T	N

TABLE 1. N, N, G/T

CODON		Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)	
GGT	YES	GLYCINE	2	NONPOLAR (NPL)	15		
GGC	NO						
GGA	NO						
GGG	YES						
GCT	YES	ALANINE	2				
GCC	NO						
GCA	NO						
GCG	YES						
GTT	YES	VALINE	2				
GTC	NO						
GTA	NO						
GTG	YES						
TTA	NO	LEUCINE	3				
TTG	YES						
CTT	YES						
CTC	NO						
CTA	NO						
CTG	YES						
ATT	YES	ISOLEUCINE	1				
ATC	NO						
ATA	NO						
ATG	YES	METHIONINE	1				
TTT	YES	PHENYLALANINE	1				
TTC	NO	TRYPTOPHAN	1				
TGG	YES						
CCT	YES						
CCC	NO	PROLINE	2				
CCA	NO						
CCG	YES						
TCT	YES	SERINE	3	POLAR NONIONIZABLE (POL)	9		
TCC	NO						
TCA	NO						
TCG	YES						
AGT	YES						
AGC	NO						
TGT	YES	CYSTEINE	1				
TGC	NO						
AAT	YES	ASPARAGINE	1				
AAC	NO	GLUTAMINE	1				
CAA	NO						
CAG	YES						
TAT	YES	TYROSINE	1				
TAC	NO	THREONINE	2				
ACT	YES						
ACC	NO						
ACA	NO						
ACG	YES						
GAT	YES					ASPARTIC ACID	1
GAC	NO	GLUTAMIC ACID	1			IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	2
GAA	NO						
GAG	YES						
AAA	NO	LYSINE	1			IONIZABLE: BASIC POSITIVE CHARGE (POS)	5
AAG	YES	ARGININE	3				
CGT	YES						
CGC	NO						
CGA	NO						
CGG	YES						
AGA	NO						
AGG	YES	HISTIDINE	1				
CAT	YES						
CAC	NO						
TAA	NO	STOP CODON	1	STOP SIGNAL (STP)	1		
TAG	YES						
TGA	NO						
64	32	20 Amino Acids Are Represented			NPL:POL:NEG:POS:STP = 15: 9: 2: 5: 1		



TABLE 2. N, N, G/C

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)		
GGT	NO	GLYCINE	2	NONPOLAR (NPL)	15		
GGC	YES						
GGA	NO						
GGG	YES						
GCT	NO	ALANINE	2				
GCC	YES						
GCA	NO						
GCG	YES						
GTT	NO	VALINE	2				
GTC	YES						
GTA	NO						
GTG	YES						
TTA	NO	LEUCINE	3				
TTG	YES						
CTT	NO						
CTC	YES						
CTA	NO						
CTG	YES						
ATT	NO	ISOLEUCINE	1				
ATC	YES						
ATA	NO						
ATG	YES	METHIONINE	1				
TTT	NO	PHENYLALANINE	1				
TTC	YES						
TGG	YES	TRYPTOPHAN	1				
CCT	NO	PROLINE	2				
CCC	YES						
CCA	NO						
CCG	YES						
TCT	NO	SERINE	3	POLAR NONIONIZABLE (POL)	9		
TCC	YES						
TCA	NO						
TCG	YES						
AGT	NO						
AGC	YES						
TGT	NO	CYSTEINE	1				
TGC	YES						
AAT	NO	ASPARAGINE	1				
AAC	YES	GLUTAMINE	1				
CAA	NO						
CAG	YES	TYROSINE	1				
TAT	NO						
TAC	YES	THREONINE	2				
ACT	NO						
ACC	YES						
ACA	NO						
ACG	YES						
GAT	NO	ASPARTIC ACID	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	2		
GAC	YES	GLUTAMIC ACID	1				
GAA	NO						
GAG	YES						
AAA	NO	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	5		
AAG	YES						
CGT	NO	ARGININE	3				
CGC	YES						
CGA	NO						
CGG	YES						
AGA	NO						
AGG	YES						
CAT	NO	HISTIDINE	1				
CAC	YES						
TAA	NO	STOP CODON	1			STOP SIGNAL (STP)	1
TAG	YES						
TGA	NO						
TOTAL	64	32	20 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 15: 9: 2: 5: 1			

TABLE 3. N, N, G/A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	NO	GLYCINE	2	NONPOLAR (NPL)	15
GGC	NO				
GGA	YES				
GGG	YES				
GCT	NO	ALANINE	2		
GCC	NO				
GCA	YES				
GCG	YES				
GTT	NO	VALINE	2		
GTC	NO				
GTA	YES				
GTG	YES				
TTA	YES	LEUCINE	4		
TTG	YES				
CTT	NO				
CTC	NO				
CTA	YES				
CTG	YES				
ATT	NO	ISOLEUCINE	1		
ATC	NO				
ATA	YES				
ATG	YES	METHIONINE	1		
TTT	NO	PHENYLALANINE	0		
TTC	NO				
TGG	YES	TRYPTOPHAN	1		
CCT	NO	PROLINE	2		
CCC	NO				
CCA	YES				
CCG	YES				
TCT	NO				
TCC	NO	POLAR NONIONIZABLE (POL)	6		
TCA	YES				
TCG	YES				
AGT	NO				
AGC	NO				
TGT	NO			CYSTEINE	0
TGC	NO				
AAT	NO			ASPARAGINE	0
AAC	NO				
CAA	YES			GLUTAMINE	2
CAG	YES				
TAT	NO			TYROSINE	0
TAC	NO			THREONINE	2
ACT	NO				
ACC	NO				
ACA	YES				
ACG	YES				
GAT	NO	ASPARTIC ACID	0		
GAC	NO	GLUTAMIC ACID	2		
GAA	YES				
GAG	YES				
AAA	YES	LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	6
AAG	YES				
CGT	NO	ARGININE	4		
CGC	NO				
CGA	YES				
CGG	YES				
AGA	YES				
AGG	YES				
CAT	NO	HISTIDINE	0		
CAC	NO				
TAA	YES	STOP CODON	3	STOP SIGNAL (STP)	3
TAG	YES				
TGA	YES				
64	32	14 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 15: 6: 2: 6: 3	

TABLE 4. N, N, A/C

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	NO	GLYCINE	2	NONPOLAR (NPL)	14
GGC	YES				
GGA	YES				
GGG	NO				
GCT	NO	ALANINE	2		
GCC	YES				
GCA	YES				
GCG	NO				
GTT	NO	VALINE	2		
GTC	YES				
GTA	YES				
GTG	NO				
TTA	YES	LEUCINE	3		
TTG	NO				
CTT	NO				
CTC	YES				
CTA	YES				
CTG	NO				
ATT	NO	ISOLEUCINE	2		
ATC	YES				
ATA	YES				
ATG	NO	METHIONINE	0		
TTT	NO	PHENYLALANINE	1		
TTC	YES	TRYPTOPHAN	0		
TGG	NO				
CCT	NO	PROLINE	2		
CCC	YES				
CCA	YES				
CCG	NO				
TCT	NO	SERINE	3	POLAR NONIONIZABLE (POL)	9
TCC	YES				
TCA	YES				
TCG	NO				
AGT	NO				
AGC	YES				
TGT	NO	CYSTEINE	1		
TGC	YES				
AAT	NO	ASPARAGINE	1		
AAC	YES				
CAA	YES	GLUTAMINE	1		
CAG	NO				
TAT	NO	TYROSINE	1		
TAC	YES				
ACT	NO	THREONINE	2		
ACC	YES				
ACA	YES				
ACG	NO				
GAT	NO	ASPARTIC ACID	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	2
GAC	YES				
GAA	YES	GLUTAMIC ACID	1		
GAG	NO				
AAA	YES	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	5
AAG	NO				
CGT	NO	ARGININE	3		
CGC	YES				
CGA	YES				
CGG	NO				
AGA	YES				
AGG	NO				
CAT	NO	HISTIDINE	1		
CAC	YES				
TAA	YES	STOP CODON	2	STOP SIGNAL (STP)	2
TAG	NO				
TGA	YES				
TOTAL	64	32	18 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 14: 9: 2: 5: 2	



TABLE 5. N, N, A/T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	2	NONPOLAR (NPL)	14
GGC	NO				
GGA	YES				
GGG	NO				
GCT	YES	ALANINE	2		
GCC	NO				
GCA	YES				
GCG	NO				
GTT	YES	VALINE	2		
GTC	NO				
GTA	YES				
GTG	NO				
TTA	YES	LEUCINE	3		
TTG	NO				
CTT	YES				
CTC	NO				
CTA	YES				
CTG	NO				
ATT	YES	ISOLEUCINE	2		
ATC	NO				
ATA	YES				
ATG	NO	METHIONINE	0		
TTT	YES	PHENYLALANINE	1		
TTC	NO				
TGG	NO	TRYPTOPHAN	0		
CCT	YES	PROLINE	2		
CCC	NO				
CCA	YES				
CCG	NO				
TCT	YES	SERINE	3	POLAR NONIONIZABLE (POL)	9
TCC	NO				
TCA	YES				
TCG	NO				
AGT	YES				
AGC	NO				
TGT	YES	CYSTEINE	1		
TGC	NO				
AAT	YES	ASPARAGINE	1		
AAC	NO				
CAA	YES	GLUTAMINE	1		
CAG	NO				
TAT	YES	TYROSINE	1		
TAC	NO				
ACT	YES	THREONINE	2		
ACC	NO				
ACA	YES				
ACG	NO				
GAT	YES	ASPARTIC ACID	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	2
GAC	NO				
GAA	YES	GLUTAMIC ACID	1		
GAG	NO				
AAA	YES	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	5
AAG	NO				
CGT	YES	ARGININE	3		
CGC	NO				
CGA	YES				
CGG	NO				
AGA	YES				
AGG	NO				
CAT	YES	HISTIDINE	1		
CAC	NO				
TAA	YES	STOP CODON	2	STOP SIGNAL (STP)	2
TAG	NO				
TGA	YES				
64	32	18 Amino Acids Are Represented		NPL: POL: NEG: POS: STP = 14: 9: 2: 5: 2	

TABLE 6. N, N, C/T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)		
GGT	YES	GLYCINE	2	NONPOLAR (NPL)	14		
GGC	YES						
GGA	NO						
GGG	NO						
GCT	YES	ALANINE	2				
GCC	YES						
GCA	NO						
GCG	NO						
GTT	YES	VALINE	2				
GTC	YES						
GTA	NO						
GTG	NO						
TTA	NO	LEUCINE	2				
TTG	NO						
CTT	YES						
CTC	YES						
CTA	NO						
CTG	NO						
ATT	YES	ISOLEUCINE	2				
ATC	YES						
ATA	NO						
ATG	NO	METHIONINE	0				
TIT	YES	PHENYLALANINE	2				
TTC	YES						
TGG	NO	TRYPTOPHAN	0				
CCT	YES	PROLINE	2				
CCC	YES						
CCA	NO						
CCG	NO						
TCT	YES	SERINE	4	POLAR NONIONIZABLE (POL)	12		
TCC	YES						
TCA	NO						
TCG	NO						
AGT	YES						
AGC	YES						
TGT	YES	CYSTEINE	2				
TGC	YES						
AAT	YES	ASPARAGINE	2				
AAC	YES						
CAA	NO	GLUTAMINE	0				
CAG	NO						
TAT	YES	TYROSINE	2				
TAC	YES						
ACT	YES	THREONINE	2				
ACC	YES						
ACA	NO						
ACG	NO						
GAT	YES	ASPARTIC ACID	2			IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	2
GAC	YES						
GAA	NO	GLUTAMIC ACID	0				
GAG	NO						
AAA	NO	LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	4		
AAG	NO						
CGT	YES	ARGININE	2				
CGC	YES						
CGA	NO						
CGG	NO						
AGA	NO						
AGG	NO						
CAT	YES	HISTIDINE	2				
CAC	YES						
TAA	NO	STOP CODON	0	STOP SIGNAL (STP)	0		
TAG	NO						
TGA	NO						
TOTAL	64	32	15 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 14: 12: 2: 4: 0			

TABLE 7. N, N, N

TABLE 7. A, N, N, N					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	4	NONPOLAR (NPL)	29
GGC	YES				
GGA	YES				
GGG	YES				
GCT	YES	ALANINE	4		
GCC	YES				
GCA	YES				
GCG	YES				
GTT	YES	VALINE	4		
GTC	YES				
GTA	YES				
GTG	YES				
TTA	YES	LEUCINE	6		
TTG	YES				
CTT	YES				
CTC	YES				
CTA	YES				
CTG	YES				
ATT	YES	ISOLEUCINE	3		
ATC	YES				
ATA	YES				
ATG	YES	METHIONINE	1		
TTT	YES	PHENYLALANINE	2		
TTC	YES				
TGG	YES	TRYPTOPHAN	1		
CCT	YES	PROLINE	4		
CCC	YES				
CCA	YES				
CCG	YES				
TCT	YES	SERINE	6	POLAR NONIONIZABLE (POL)	18
TCC	YES				
TCA	YES				
TCG	YES				
AGT	YES				
AGC	YES				
TGT	YES	CYSTEINE	2		
TGC	YES				
AAT	YES	ASPARAGINE	2		
AAC	YES	GLUTAMINE	2		
CAA	YES				
CAG	YES	TYROSINE	2		
TAT	YES				
TAC	YES	THREONINE	4		
ACT	YES				
ACC	YES				
ACA	YES				
ACG	YES				
GAT	YES	ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	4
GAC	YES	GLUTAMIC ACID	2		
GAA	YES				
GAG	YES				
AAA	YES	LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	10
AAG	YES				
CGT	YES	ARGININE	6		
CGC	YES				
CGA	YES				
CGG	YES				
AGA	YES				
AGG	YES				
CAT	YES	HISTIDINE	2		
CAC	YES				
TAA	YES	STOP CODON	3	STOP SIGNAL (STP)	3
TAG	YES				
TGA	YES				
TOTAL	64	64	20 Amino Acids Are Represented	NPL: POL: NEG: POS: STP 29: 18: 4: 10: 3	

TABLE 8. N, N, G

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	NO	GLYCINE	1	NONPOLAR (NPL)	8
GGC	NO				
GGA	NO				
GGG	YES				
GCT	NO	ALANINE	1		
GCC	NO				
GCA	NO				
GCG	YES				
GTT	NO	VALINE	1		
GTC	NO				
GTA	NO				
GTG	YES				
TTA	NO	LEUCINE	2		
TTG	YES				
CTT	NO				
CTC	NO				
CTA	NO				
CTG	YES				
ATT	NO	ISOLEUCINE	0		
ATC	NO				
ATA	NO				
ATG	YES	METHIONINE	1		
TTT	NO	PHENYLALANINE	0		
TTC	NO	TRYPTOPHAN	1		
TGG	YES				
CCT	NO	PROLINE	1		
CCC	NO				
CCA	NO				
CCG	YES				
TCT	NO	SERINE	1	POLAR NONIONIZABLE (POL)	3
TCC	NO				
TCA	NO				
TCG	YES				
AGT	NO				
AGC	NO				
TGT	NO	CYSTEINE	0		
TGC	NO				
AAT	NO	ASPARAGINE	0		
AAC	NO				
CAA	NO	GLUTAMINE	1		
CAG	YES				
TAT	NO	TYROSINE	0		
TAC	NO				
ACT	NO	THREONINE	1		
ACC	NO				
ACA	NO				
ACG	YES				
GAT	NO	ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
GAC	NO	GLUTAMIC ACID	1		
GAA	NO				
GAG	YES				
AAA	NO	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	3
AAG	YES				
CGT	NO	ARGININE	2		
CGC	NO				
CGA	NO				
CGG	YES				
AGA	NO				
AGG	YES				
CAT	NO	HISTIDINE	0		
CAC	NO				
TAA	NO	STOP CODON	1	STOP SIGNAL (STP)	1
TAG	YES				
TGA	NO				
64	16	13 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 8: 3: 1: 3: 1	

TABLE 9. N, N, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	NO	GLYCINE	1	NONPOLAR (NPL)	7
GGC	NO				
GGA	YES				
GGG	NO				
GCT	NO	ALANINE	1		
GCC	NO				
GCA	YES				
GCG	NO				
GTT	NO	VALINE	1		
GTC	NO				
GTA	YES				
GTG	NO				
TTA	YES	LEUCINE	2		
TTG	NO				
CTT	NO				
CTC	NO				
CTA	YES				
CTG	NO				
ATT	NO	ISOLEUCINE	1		
ATC	NO				
ATA	YES				
ATG	NO	METHIONINE	0		
TTT	NO	PHENYLALANINE	0		
TTC	NO	TRYPTOPHAN	0		
TGG	NO				
CCT	NO	PROLINE	1		
CCC	NO				
CCA	YES				
CCG	NO				
TCT	NO	SERINE	1	POLAR NONIONIZABLE (POL)	3
TCC	NO				
TCA	YES				
TCG	NO				
AGT	NO				
AGC	NO				
TGT	NO	CYSTEINE	0		
TGC	NO				
AAT	NO	ASPARAGINE	0		
AAC	NO				
CAA	YES	GLUTAMINE	1		
CAG	NO				
TAT	NO	TYROSINE	0		
TAC	NO				
ACT	NO	THREONINE	1		
ACC	NO				
ACA	YES				
ACG	NO				
GAT	NO	ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
GAC	NO	GLUTAMIC ACID	1		
GAA	YES				
GAG	NO				
AAA	YES	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	3
AAG	NO				
CGT	NO	ARGININE	2		
CGC	NO				
CGA	YES				
CGG	NO				
AGA	YES				
AGG	NO				
CAT	NO	HISTIDINE	0		
CAC	NO				
TAA	YES	STOP CODON	2		
TAG	NO				
TGA	YES				
64	16	12 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 7: 3: 1: 3: 2	



TABLE 10. N, N, C

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	NO	GLYCINE	1	NONPOLAR (NPL)	7
GGC	YES				
GGA	NO				
GGG	NO				
GCT	NO	ALANINE	1		
GCC	YES				
GCA	NO				
GCG	NO				
GTT	NO	VALINE	1		
GTC	YES				
GTA	NO				
GTG	NO				
TFA	NO	LEUCINE	1		
TTG	NO				
CTT	NO				
CTC	YES				
CTA	NO				
CTG	NO				
ATT	NO	ISOLEUCINE	1		
ATC	YES				
ATA	NO				
ATG	NO	METHIONINE	0		
TTT	NO	PHENYLALANINE	1		
TTC	YES				
TGG	NO	TRYPTOPHAN	0		
CCT	NO	PROLINE	1		
CCC	YES				
CCA	NO				
CCG	NO				
TCT	NO	SERINE	2	POLAR NONIONIZABLE (POL)	6
TCC	YES				
TCA	NO				
TCG	NO				
AGT	NO				
AGC	YES				
TGT	NO	CYSTEINE	1		
TGC	YES				
AAT	NO	ASPARAGINE	1		
AAC	YES				
CAA	NO	GLUTAMINE	0		
CAG	NO				
TAT	NO	TYROSINE	1		
TAC	YES				
ACT	NO	THREONINE	1		
ACC	YES				
ACA	NO				
ACG	NO				
GAT	NO	ASPARTIC ACID	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
GAC	YES				
GAA	NO	GLUTAMIC ACID	0		
GAG	NO				
AAA	NO	LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	2
AAG	NO				
CGT	NO	ARGININE	1		
CGC	YES				
CGA	NO				
CGG	NO				
AGA	NO				
AGG	NO				
CAT	NO	HISTIDINE	1		
CAC	YES				
TAA	NO	STOP CODON	0	STOP SIGNAL (STP)	0
TAG	NO				
TGA	NO				
TOTAL	64	16	15 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 7: 6: 1: 2: 0	

TABLE 11. N, N, T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	1	NONPOLAR (NPL)	7
GGC	NO				
GGA	NO				
GGG	NO				
GCT	YES	ALANINE	1		
GCC	NO				
GCA	NO				
GCG	NO				
GTT	YES	VALINE	1		
GTC	NO				
GTA	NO				
GTG	NO				
TTA	NO	LEUCINE	1		
TTG	NO				
CTT	YES				
CTC	NO				
CTA	NO				
CTG	NO				
ATT	YES	ISOLEUCINE	1		
ATC	NO				
ATA	NO				
ATG	NO	METHIONINE	0		
TTT	YES	PHENYLALANINE	1		
TTC	NO				
TGG	NO	TRYPTOPHAN	0		
CCT	YES	PROLINE	1		
CCC	NO				
CCA	NO				
CCG	NO				
TCT	YES	SERINE	2	POLAR NONIONIZABLE (POL)	6
TCC	NO				
TCA	NO				
TCG	NO				
AGT	YES				
AGC	NO				
TGT	YES	CYSTEINE	1		
TGC	NO				
AAT	YES	ASPARAGINE	1		
AAC	NO				
CAA	NO	GLUTAMINE	0		
CAG	NO				
TAT	YES	TYROSINE	1		
TAC	NO				
ACT	YES	THREONINE	1		
ACC	NO				
ACA	NO				
ACG	NO				
GAT	YES	ASPARTIC ACID	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
GAC	NO				
GAA	NO	GLUTAMIC ACID	0		
GAG	NO				
AAA	NO	LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	2
AAG	NO				
CGT	YES	ARGININE	1		
CGC	NO				
CGA	NO				
CGG	NO				
AGA	NO				
AGG	NO				
CAT	YES	HISTIDINE	1		
CAC	NO				
TAA	NO	STOP CODON	0	STOP SIGNAL (STP)	0
TAG	NO				
TGA	NO				
64	16	15 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 7: 6: 1: 2: 0	

TABLE 12. N, N, C/G/T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	3	NONPOLAR (NPL)	22
GGC	YES				
GGA	NO				
GGG	YES				
GCT	YES	ALANINE	3		
GCC	YES				
GCA	NO				
GCG	YES				
GTT	YES	VALINE	3		
GTC	YES				
GTA	NO				
GTG	YES				
TTA	NO	LEUCINE	4		
TTG	YES				
CTT	YES				
CTC	YES				
CTA	NO				
CTG	YES	ISOLEUCINE	2		
ATT	YES				
ATC	YES				
ATA	NO	METHIONINE	1		
ATG	YES				
TTT	YES	PHENYLALANINE	2		
TTC	YES				
TGG	YES	TRYPTOPHAN	1		
CCT	YES	PROLINE	3		
CCC	YES				
CCA	NO				
CCG	YES				
TCT	YES	SERINE	5	POLAR NONIONIZABLE (POL)	15
TCC	YES				
TCA	NO				
TCG	YES				
AGT	YES				
AGC	YES				
TGT	YES	CYSTEINE	2		
TGC	YES				
AAT	YES	ASPARAGINE	2		
AAC	YES				
CAA	NO	GLUTAMINE	1		
CAG	YES				
TAT	YES	TYROSINE	2		
TAC	YES				
ACT	YES	THREONINE	3		
ACC	YES				
ACA	NO				
ACG	YES				
GAT	YES	ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	3
GAC	YES				
GAA	NO	GLUTAMIC ACID	1		
GAG	YES				
AAA	NO	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	7
AAG	YES				
CGT	YES	ARGININE	4		
CGC	YES				
CGA	NO				
CGG	YES				
AGA	NO				
AGG	YES	HISTIDINE	2		
CAT	YES				
CAC	YES				
TAA	NO	STOP CODON	1	STOP SIGNAL (STP)	1
TAG	YES				
TGA	NO				
TOTAL	64	48	20 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 22: 15: 3: 7: 1	

TABLE 13. N, N, A/G/T

TABLE 15. N, N, A/G/I					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	3	NONPOLAR (NPL)	22
GGC	NO				
GGA	YES				
GGG	YES				
GCT	YES	ALANINE	3		
GCC	NO				
GCA	YES				
GCG	YES				
GTT	YES	VALINE	3		
GTC	NO				
GTA	YES				
GTG	YES				
TTA	YES	LEUCINE	5		
TTG	YES				
CTT	YES				
CTC	NO				
CTA	YES				
CTG	YES				
ATT	YES	ISOLEUCINE	2		
ATC	NO				
ATA	YES				
ATG	YES	METHIONINE	1		
TTT	YES	PHENYLALANINE	1		
TTC	NO	TRYPTOPHAN	1		
TGG	YES				
CCT	YES	PROLINE	3		
CCC	NO	POLAR NONIONIZABLE (POL)	12		
CCA	YES				
CCG	YES				
TCT	YES			SERINE	4
TCC	NO				
TCA	YES				
TCG	YES				
AGT	YES				
AGC	NO				
TGT	YES			CYSTEINE	1
TGC	NO				
AAT	YES			ASPARAGINE	1
AAC	NO			GLUTAMINE	2
CAA	YES				
CAG	YES			TYROSINE	1
TAT	YES				
TAC	NO			THREONINE	3
ACT	YES				
ACC	NO				
ACA	YES				
ACG	YES			ASPARTIC ACID	1
GAT	YES				
GAC	NO			GLUTAMIC ACID	2
GAA	YES				
GAG	YES			LYSINE	2
AAA	YES				
AAG	YES			ARGININE	5
CGT	YES				
CGC	NO				
CGA	YES				
CGG	YES				
AGA	YES				
AGG	YES				
CAT	YES	HISTIDINE	1		
CAC	NO				
TAA	YES	STOP CODON	3	STOP SIGNAL (STP)	3
TAG	YES				
TGA	YES				
TOTAL	64	48	20 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 22: 12: 3: 8: 3	

TABLE 14. N, N, A/C/T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	3	NONPOLAR (NPL)	21
GGC	YES				
GGA	YES				
GGG	NO				
GCT	YES	ALANINE	3		
GCC	YES				
GCA	YES				
GCG	NO				
GTT	YES	VALINE	3		
GTC	YES				
GTA	YES				
GTG	NO				
TTA	YES	LEUCINE	4		
TTG	NO				
CTT	YES				
CTC	YES				
CTA	YES				
CTG	NO				
ATT	YES	ISOLEUCINE	3		
ATC	YES				
ATA	YES				
ATG	NO	METHIONINE	0		
TIT	YES	PHENYLALANINE	2		
TTC	YES				
TGG	NO	TRYPTOPHAN	0		
CCT	YES	PROLINE	3		
CCC	YES				
CCA	YES				
CCG	NO				
TCT	YES	SERINE	5	POLAR NONIONIZABLE (POL)	15
TCC	YES				
TCA	YES				
TCG	NO				
AGT	YES				
AGC	YES				
TGT	YES	CYSTEINE	2		
TGC	YES				
AAT	YES	ASPARAGINE	2		
AAC	YES				
CAA	YES	GLUTAMINE	1		
CAG	NO				
TAT	YES	TYROSINE	2		
TAC	YES				
ACT	YES	THREONINE	3		
ACC	YES				
ACA	YES				
ACG	NO				
GAT	YES	ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	3
GAC	YES				
GAA	YES	GLUTAMIC ACID	1		
GAG	NO				
AAA	YES	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	7
AAG	NO				
CGT	YES	ARGININE	4		
CGC	YES				
CGA	YES				
CGG	NO				
AGA	YES				
AGG	NO				
CAT	YES	HISTIDINE	2		
CAC	YES				
TAA	YES	STOP CODON	2	STOP SIGNAL (STP)	2
TAG	NO				
TGA	YES				
TOTAL	64	48	18 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 21: 15: 3: 7: 2	



TABLE 15. N, N, A/C/G

TABLE 15.1, 15.2					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	NO	GLYCINE	3	NONPOLAR (NPL)	22
GGC	YES				
GGA	YES				
GGG	YES				
GCT	NO	ALANINE	3		
GCC	YES				
GCA	YES				
GCG	YES				
GTT	NO	VALINE	3		
GTC	YES				
GTA	YES				
GTG	YES				
TTA	YES	LEUCINE	5		
TTG	YES				
CTT	NO				
CTC	YES				
CTA	YES				
CTG	YES				
ATT	NO	ISOLEUCINE	2		
ATC	YES				
ATA	YES				
ATG	YES	METHIONINE	1		
TTT	NO	PHENYLALANINE	1		
TTC	YES				
TGG	YES	TRYPTOPHAN	1		
CCT	NO	PROLINE	3		
CCC	YES				
CCA	YES				
CCG	YES				
TCT	NO	SERINE	4	POLAR NONIONIZABLE (POL)	12
TCC	YES				
TCA	YES				
TCG	YES				
AGT	NO				
AGC	YES				
TGT	NO	CYSTEINE	1		
TGC	YES				
AAT	NO	ASPARAGINE	1		
AAC	YES				
CAA	YES	GLUTAMINE	2		
CAG	YES				
TAT	NO	TYROSINE	1		
TAC	YES				
ACT	NO	THREONINE	3		
ACC	YES				
ACA	YES				
ACG	YES				
GAT	NO	ASPARTIC ACID	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	3
GAC	YES				
GAA	YES	GLUTAMIC ACID	2		
GAG	YES				
AAA	YES	LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	8
AAG	YES				
CGT	NO	ARGININE	5		
CGC	YES				
CGA	YES				
CGG	YES				
AGA	YES				
AGG	YES				
CAT	NO	HISTIDINE	1		
CAC	YES				
TAA	YES	STOP CODON	3	STOP SIGNAL (STP)	3
TAG	YES				
TGA	YES				
TOTAL	64	48	20 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 22: 12: 3: 8: 3	

TABLE 16. N, A, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	0
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	1
		CYSTEINE	0		
		ASPARAGINE	0		
CAA	YES	GLUTAMINE	1		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
GAA	YES	GLUTAMIC ACID	1		
AAA	YES	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	1
		ARGININE	0		
		HISTIDINE	0		
TAA	YES	STOP CODON	1	STOP SIGNAL (STP)	1
TOTAL	4	3 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 0: 1: 1: 1: 1	

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TABLE 17. N, A, C

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	0
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	2
		CYSTEINE	0		
AAC	YES	ASPARAGINE	1		
		GLUTAMINE	0		
TAC	YES	TYROSINE	1		
		THREONINE	0		
GAC	YES	ASPARTIC ACID	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	1
		ARGININE	0		
CAC	YES	HISTIDINE	1		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL	4	4 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 0: 2: 1: 1: 0	

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TABLE 18. N, A, G

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	0
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	1
		CYSTEINE	0		
		ASPARAGINE	0		
CAG	YES	GLUTAMINE	1		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
GAG	YES	GLUTAMIC ACID	1		
AAG	YES	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	1
		ARGININE	0		
		HISTIDINE	0		
TAG	YES	STOP CODON	1	STOP SIGNAL (STP)	1
TOTAL		4	3 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 0: 1: 1: 1: 1	

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TABLE 19. N, A, T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	0
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	2
		CYSTEINE	0		
AAT	YES	ASPARAGINE	1		
		GLUTAMINE	0		
TAT	YES	TYROSINE	1		
		THREONINE	0		
GAT	YES	ASPARTIC ACID	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	1
		ARGININE	0		
CAT	YES	HISTIDINE	1		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL		4	4 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 0: 2: 1: 1: 0	

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TABLE 20. N, C, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	2
GCA	YES	ALANINE	1		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCA	YES	PROLINE	1	POLAR NONIONIZABLE (POL)	2
TCA	YES	SERINE	1		
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
ACA	YES	THREONINE	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		LYSINE	0		
		ARGININE	0		
		HISTIDINE	0	STOP SIGNAL (STP)	0
		STOP CODON	0		
TOTAL		4	4 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 2: 2: 0: 0: 0	

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TABLE 21. N, C, C

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	2
GCC	YES	ALANINE	1		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCC	YES	PROLINE	1	POLAR NONIONIZABLE (POL)	2
TCC	YES	SERINE	1		
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
ACC	YES	THREONINE	1		
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		ARGININE	0		
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL		4	4 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 2: 2: 0: 0: 0	

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TABLE 22. N, C, G

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	2
GCG	YES	ALANINE	1		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCG	YES	PROLINE	1		
TCG	YES	SERINE	1	POLAR NONIONIZABLE (POL)	2
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
ACG	YES	THREONINE	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		LYSINE	0		
		ARGININE	0		
		HISTIDINE	0	STOP SIGNAL (STP)	0
		STOP CODON	0		
4				4 Amino Acids Are Represented	
				NPL:POL:NEG:POS:STP = 2: 2: 0: 0: 0	

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TABLE 23. N, C, T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	2
GCT	YES	ALANINE	1		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCT	YES	PROLINE	1		
TCT	YES	SERINE	1	POLAR NONIONIZABLE (POL)	2
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
ACT	YES	THREONINE	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		LYSINE	0		
		ARGININE	0		
		HISTIDINE	0	STOP SIGNAL (STP)	0
		STOP CODON	0		
4		4 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 2: 2: 0: 0: 0	

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TABLE 24. N, G, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGA	YES	GLYCINE	1	NONPOLAR (NPL)	1
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	0
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	2
CGA	YES	ARGININE	2		
AGA	YES				
		HISTIDINE	0		
TGA	YES	STOP CODON	1	STOP SIGNAL (STP)	1
TOTAL	4	2 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 1: 0: 0: 2: 1	

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TABLE 25. N, G, C

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGC	YES	GLYCINE	1	NONPOLAR (NPL)	1
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
AGC	YES	SERINE	1	POLAR NONIONIZABLE (POL)	2
TGC	YES	CYSTEINE	1		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	1
CGC	YES	ARGININE	1		
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL	4	4 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 1: 2: 0: 1: 0	

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TABLE 26. N, G, G

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGG	YES	GLYCINE	1	NONPOLAR (NPL)	2
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
TGG	YES	TRYPTOPHAN	1		
		PROLINE	0	POLAR NONIONIZABLE (POL)	0
		SERINE	0		
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	2
CGG	YES	ARGININE	2		
AGG	YES	HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL	4	3 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 2: 0: 0: 2: 0	

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TABLE 27. N, G, T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	1	NONPOLAR (NPL)	1
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0	POLAR NONIONIZABLE (POL)	2
AGT	YES	SERINE	1		
TGT	YES	CYSTEINE	1		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	1
CGT	YES	ARGININE	1		
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL	4	4 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 1: 2: 0: 1: 0	

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TABLE 28. N, T, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	4
		ALANINE	0		
GTA	YES	VALINE	1		
TTA	YES	LEUCINE	2		
CTA	YES				
ATA	YES	ISOLEUCINE	1		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	0
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		ARGININE	0		
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL	4	3 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 4: 0: 0: 0: 0	

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TABLE 29. N, T, C

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	4
		ALANINE	0		
GTC	YES	VALINE	1		
CTC	YES	LEUCINE	1		
ATC	YES	ISOLEUCINE	1		
		METHIONINE	0		
TTC	YES	PHENYLALANINE	1		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	0
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		ARGININE	0		
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL	4	4 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 4: 0: 0: 0: 0	

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TABLE 30. N, T, G

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	4
		ALANINE	0		
GTG	YES	VALINE	1		
TTG	YES	LEUCINE	2		
CTG	YES				
		ISOLEUCINE	0		
ATG	YES	METHIONINE	1		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	0
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		ARGININE	0		
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL	4	3 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 4: 0: 0: 0: 0	

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TABLE 31. N, T, T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	4
		ALANINE	0		
GTT	YES	VALINE	1		
CTT	YES	LEUCINE	1		
ATT	YES	ISOLEUCINE	1		
		METHIONINE	0		
TTT	YES	PHENYLALANINE	1		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	0
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		ARGININE	0		
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL	4	4 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 4: 0: 0: 0: 0	

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TABLE 32. N, A/C, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	2
GCA	YES	ALANINE	1		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCA	YES	PROLINE	1		
TCA	YES	SERINE	1	POLAR NONIONIZABLE (POL)	3
		CYSTEINE	0		
		ASPARAGINE	0		
CAA	YES	GLUTAMINE	1		
		TYROSINE	0		
ACA	YES	THREONINE	1		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
GAA	YES	GLUTAMIC ACID	1		
AAA	YES	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	1
		ARGININE	0		
		HISTIDINE	0		
TAA	YES	STOP CODON	1	STOP SIGNAL (STP)	1
TOTAL		8	7 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 2: 3: 1: 1: 1	

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TABLE 33. N, A/G, A

TABLE 33. N, A/G, A					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGA	YES	GLYCINE	1	NONPOLAR (NPL)	1
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	1
		CYSTEINE	0		
		ASPARAGINE	0		
CAA	YES	GLUTAMINE	1		
		TYROSINE	0		
		THREONINE	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
		ASPARTIC ACID	0		
GAA	YES	GLUTAMIC ACID	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	3
AAA	YES	LYSINE	1		
CGA	YES	ARGININE	2		
AGA	YES				
		HISTIDINE	0		
TAA	YES	STOP CODON	2	STOP SIGNAL (STP)	2
TGA	YES				
TOTAL		8	5 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 1: 1: 1: 3: 2	



TABLE 34. N, A/T, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	4
		ALANINE	0		
GTA	YES	VALINE	1		
TTA	YES	LEUCINE	2		
CTA	YES				
ATA	YES	ISOLEUCINE	1		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	1
		CYSTEINE	0		
		ASPARAGINE	0		
CAA	YES	GLUTAMINE	1		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
GAA	YES	GLUTAMIC ACID	1		
AAA	YES	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	1
		ARGININE	0		
		HISTIDINE	0		
TAA	YES	STOP CODON	1	STOP SIGNAL (STP)	1
TOTAL	8	6 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 4: 1: 1: 1: 1	

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TABLE 35. N, C/G, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)		
GGA	YES	GLYCINE	1	NONPOLAR (NPL)	3		
GCA	YES	ALANINE	1				
		VALINE	0				
		LEUCINE	0				
		ISOLEUCINE	0				
		METHIONINE	0				
		PHENYLALANINE	0				
		TRYPTOPHAN	0				
CCA	YES	PROLINE	1				
TCA	YES	SERINE	1	POLAR NONIONIZABLE (POL)	2		
		CYSTEINE	0				
		ASPARAGINE	0				
		GLUTAMINE	0				
		TYROSINE	0				
ACA	YES	THREONINE	1				
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0		
		GLUTAMIC ACID	0				
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	2		
CGA	YES	ARGININE	2				
AGA	YES						
		HISTIDINE	0	STOP SIGNAL (STP)	1		
TGA	YES	STOP CODON	1				
TOTAL				8	6 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 3: 2: 0: 2: 1	

TABLE 36. N, C/T, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	6
GCA	YES	ALANINE	1		
GTA	YES	VALINE	1		
TTA	YES	LEUCINE	2		
CTA	YES				
ATA	YES	ISOLEUCINE	1		
		METHIONINE	0	POLAR NONIONIZABLE (POL)	2
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCA	YES	PROLINE	1		
TCA	YES	SERINE	1		
		CYSTEINE	0		
		ASPARAGINE	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMINE	0		
		TYROSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
ACA	YES	THREONINE	1		
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0	STOP SIGNAL (STP)	0
		LYSINE	0		
		ARGININE	0		
		HISTIDINE	0		
		STOP CODON	0		
TOTAL		8	7 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 6: 2: 0: 0: 0	

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TABLE 37. N, T/G, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGA	YES	GLYCINE	1	NONPOLAR (NPL)	5
		ALANINE	0		
GTA	YES	VALINE	1		
TTA	YES	LEUCINE	2		
CTA	YES				
ATA	YES	ISOLEUCINE	1		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	0
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		LYSINE	0		
CGA	YES	ARGININE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	2
AGA	YES				
		HISTIDINE	0		
TGA	YES	STOP CODON	1	STOP SIGNAL (STP)	1
TOTAL		8	5 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 5: 0: 0: 2: 1	

TABLE 38. N, C/G/T, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGA	YES	GLYCINE	1	NONPOLAR (NPL)	7
GCA	YES	ALANINE	1		
GTA	YES	VALINE	1		
TTA	YES	LEUCINE	2		
CTA	YES				
ATA	YES	ISOLEUCINE	1		
		METHIONINE	0		
		PHENYLALANINE	0	POLAR NONIONIZABLE (POL)	2
		TRYPTOPHAN	0		
CCA	YES	PROLINE	1		
TCA	YES	SERINE	1		
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
ACA	YES	THREONINE	1		
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	2
		LYSINE	0		
CGA	YES	ARGININE	2		
AGA	YES			STOP SIGNAL (STP)	1
		HISTIDINE	0		
TGA	YES	STOP CODON	1		
TOTAL		12	9 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 7: 2: 0: 2: 1	

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TABLE 39. N, A/G/T, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGA	YES	GLYCINE	1	NONPOLAR (NPL)	5
		ALANINE	0		
GTA	YES	VALINE	1		
TTA	YES	LEUCINE	2		
CTA	YES				
ATA	YES	ISOLEUCINE	1		
		METHIONINE	0		
		PHENYLALANINE	0	POLAR NONIONIZABLE (POL)	1
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0		
		CYSTEINE	0		
		ASPARAGINE	0		
CAA	YES	GLUTAMINE	1		
		TYROSINE	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
		THREONINE	0		
GAA	YES	GLUTAMIC ACID	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	3
AAA	YES	LYSINE	1		
CGA	YES	ARGININE	2		
AGA	YES				
		HISTIDINE	0	STOP SIGNAL (STP)	2
TAA	YES	STOP CODON	2		
TGA	YES				
TOTAL		12	8 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 5: 1: 1: 3: 2	

TABLE 40. N, A/C/T, A

TABLE 40. N, A/C/T, A					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	6
GCA	YES	ALANINE	1		
GTA	YES	VALINE	1		
TTA	YES	LEUCINE	2		
CTA	YES				
ATA	YES	ISOLEUCINE	1		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCA	YES	PROLINE	1	POLAR NONIONIZABLE (POL)	3
TCA	YES	SERINE	1		
		CYSTEINE	0		
		ASPARAGINE	0		
CAA	YES	GLUTAMINE	1		
		TYROSINE	0		
ACA	YES	THREONINE	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
		ASPARTIC ACID	0		
GAA	YES	GLUTAMIC ACID	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	1
AAA	YES	LYSINE	1		
		ARGININE	0		
		HISTIDINE	0	STOP SIGNAL (STP)	1
TAA	YES	STOP CODON	1		
TOTAL		12	10 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 6: 3: 1: 1: 1	

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TABLE 41. N, A/C/G, A

TABLE 4: N, A/C/G, A					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGA	YES	GLYCINE	1	NONPOLAR (NPL)	3
GCA	YES	ALANINE	1		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCA	YES	PROLINE	1		
TCA	YES	SERINE	1	POLAR NONIONIZABLE (POL)	3
		CYSTEINE	0		
		ASPARAGINE	0		
CAA	YES	GLUTAMINE	1		
		TYROSINE	0		
ACA	YES	THREONINE	1		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
GAA	YES	GLUTAMIC ACID	1		
AAA	YES	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	3
CGA	YES	ARGININE	2		
AGA	YES				
		HISTIDINE	0	STOP SIGNAL (STP)	2
TAA	YES	STOP CODON	2		
TGA	YES				
TOTAL	12	9 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 3: 3: 1: 3: 2	



TABLE 42. A, N, N

TABLE 42: A, N, P					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	4
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
ATT	YES	ISOLEUCINE	3		
ATC	YES				
ATA	YES				
ATG	YES				
		METHIONINE	1		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
AGT	YES	SERINE	2	POLAR NONIONIZABLE (POL)	8
AGC	YES				
		CYSTHINE	0		
AAT	YES	ASPARAGINE	2		
AAC	YES				
		GLUTAMINE	0		
		TYROSINE	0		
ACT	YES	THREONINE	4		
ACC	YES				
ACA	YES				
ACG	YES				
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
AAA	YES	LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	4
AAG	YES				
AGA	YES	ARGININE	2		
AGG	YES				
		HISTIDINE	0	STOP SIGNAL (STP)	0
		STOP CODON	0		
TOTAL		16	7 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 4: 8: 0: 4: 0	

5 TABLE 43. C, N, N

CODON		Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
			GLYCINE	0	NONPOLAR (NPL)	8
			ALANINE	0		
			VALINE	0		
CTT	YES	LEUCINE		4		
CTC	YES					
CTA	YES					
CTG	YES					
			ISOLEUCINE	0		
			METHIONINE	0		
			PHENYLALANINE	0		
			TRYPTOPHAN	0		
OCT	YES	PROLINE		4		
CCC	YES					
CCA	YES					
CCG	YES					
			SERINE	0	POLAR NONIONIZABLE (POL)	2
			CYSTEINE	0		
			ASPARAGINE	0		
CAA	YES	GLUTAMINE		2		
CAG	YES					
			TYROSINE	0		
			THREONINE	0		
			ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
			GLUTAMIC ACID	0		
			LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	6
CGT	YES	ARGININE		4		
CGC	YES					
CGA	YES					
CGG	YES					
CAT	YES	HISTIDINE		2		
CAC	YES					
			STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL		16	5 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 8: 2: 0: 6: 0	

TABLE 44. G, N, N

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	4	NONPOLAR (NPL)	12
GGC	YES				
GGA	YES				
GGG	YES				
GCT	YES	ALANINE	4		
GCC	YES				
GCA	YES				
GCG	YES				
GTT	YES	VALINE	4		
GTC	YES				
GTA	YES				
GTG	YES				
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0		
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
GAT	YES	ASPARTIC ACID	2		
GAC	YES				
GAA	YES	GLUTAMIC ACID	2		
GAG	YES				
		LYSINE	0		
		ARGININE	0		
		HISTIDINE	0		
		STOP CODON	0		
				STOP SIGNAL (STP)	0
TOTAL		16	5 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 12: 0: 4: 0: 0	

5

TABLE 45. T, N, N

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	5
		ALANINE	0		
		VALINE	0		
TTA	YES	LEUCINE	2		
TTG	YES				
		ISOLEUCINE	0		
		METHIONINE	0		
TTT	YES	PHENYLALANINE	2		
TTC	YES				
TGG	YES	TRYPTOPHAN	1		
		PROLINE	0		
TCT	YES	SERINE	4	POLAR NONIONIZABLE (POL)	8
TCC	YES				
TCA	YES				
TCG	YES				
TGT	YES	CYSTEINE	2		
TGC	YES				
		ASPARAGINE	0		
		GLUTAMINE	0		
TAT	YES	TYROSINE	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
TAC	YES				
		THREONINE	0		
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0		
		LYSINE	0		
		ARGININE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		HISTIDINE	0		
TAA	YES	STOP CODON	3		
TAG	YES			STOP SIGNAL (STP)	3
TGA	YES				
TOTAL		16	6 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 5: 8: 0: 0: 3	



TABLE 46. A/C, N, N

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	12
		ALANINE	0		
		VALINE	0		
CTT	YES	LEUCINE	4		
CTC	YES				
CTA	YES				
CTG	YES				
ATT	YES	ISOLEUCINE	3		
ATC	YES				
ATA	YES				
ATG	YES	METHIONINE	1		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCT	YES	PROLINE	4		
CCC	YES				
CCA	YES				
CCG	YES				
AGT	YES	SERINE	2	POLAR NONIONIZABLE (POL)	10
AGC	YES				
		CYSTEINE	0		
AAT	YES	ASPARAGINE	2		
AAC	YES				
CAA	YES	GLUTAMINE	2		
CAG	YES				
		TYROSINE	0		
ACT	YES	THREONINE	4		
ACC	YES				
ACA	YES				
ACG	YES				
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
AAA	YES	LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	10
AAG	YES				
CGT	YES	ARGININE	6		
CGC	YES				
CGA	YES				
CGG	YES				
AGA	YES				
AGG	YES				
CAT	YES	HISTIDINE	2		
CAC	YES				
		STOP CODON	0	STOP SIGNAL (STP)	0
32		11 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 12: 10: 0: 10: 0	

TABLE 47. A/G, N, N

A/G, N, N			
CODON	Represented	AMINO ACID (Frequency)	CATEGORY (Frequency)
GGT	YES	GLYCINE 4	NONPOLAR (NPL) 16
GGC	YES		
GGA	YES		
GGG	YES		
GCT	YES	ALANINE 4	
GCC	YES		
GCA	YES		
GCG	YES		
GTT	YES	VALINE 4	
GTC	YES		
GTA	YES		
GTG	YES		
		LEUCINE 0	
ATT	YES	ISOLEUCINE 3	
ATC	YES		
ATA	YES		
ATG	YES	METHIONINE 1	
		PHENYLALANINE 0	
		TRYPTOPHAN 0	
		PROLINE 0	
AGT	YES	SERINE 2	POLAR NONIONIZABLE (POL) 8
AGC	YES		
		CYSTEINE 0	
AAT	YES	ASPARAGINE 2	
AAC	YES		
		GLUTAMINE 0	
		TYROSINE 0	
ACT	YES	THREONINE 4	
ACC	YES		
ACA	YES		
ACG	YES		
GAT	YES	ASPARTIC ACID 2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG) 4
GAC	YES		
GAA	YES	GLUTAMIC ACID 2	
GAG	YES		
AAA	YES	LYSINE 2	IONIZABLE: BASIC POSITIVE CHARGE (POS) 4
AAG	YES		
AGA	YES	ARGININE 2	
AGG	YES		
		HISTIDINE 0	
		STOP CODON 0	STOP SIGNAL (STP) 0
32 12 Amino Acids Are Represented			NPL:POL:NEG:POS:STP = 16: 8: 4: 4: 0

TABLE 48. A/T, N, N

TABLE 48. A/I, N, N					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	9
		ALANINE	0		
		VALINE	0		
TTA	YES	LEUCINE	2		
TTG	YES				
ATT	YES	ISOLEUCINE	3		
ATC	YES				
ATA	YES				
ATG	YES				
TTT	YES	METHIONINE	1		
TTC	YES	PHENYLALANINE	2		
TGG	YES	TRYPTOPHAN	1		
		PROLINE	0		
TCT	YES	SERINE	6	POLAR NONIONIZABLE (POL)	16
TCC	YES				
TCA	YES				
TCG	YES				
AGT	YES				
AGC	YES				
TGT	YES	CYSTEINE	2		
TGC	YES				
AAT	YES	ASPARAGINE	2		
AAC	YES				
		GLUTAMINE	0		
TAT	YES	TYROSINE	2		
TAC	YES				
ACT	YES	THREONINE	4		
ACC	YES				
ACA	YES				
ACG	YES				
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0		
AAA	YES	LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	4
AAG	YES				
AGA	YES	ARGININE	2		
AGG	YES				
		HISTIDINE	0		
TAA	YES	STOP CODON	3	STOP SIGNAL (STP)	3
TAG	YES				
TGA	YES				
TOTAL	32	12 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 9: 16: 0: 4: 3	

TABLE 49. C/G, N, N

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	4	NONPOLAR (NPL)	20
GGC	YES				
GGA	YES				
GGG	YES				
GCT	YES	ALANINE	4		
GCC	YES				
GCA	YES				
GCG	YES				
GTT	YES	VALINE	4		
GTC	YES				
GTA	YES				
GTG	YES				
CTT	YES	LEUCINE	4		
CTC	YES				
CTA	YES				
CTG	YES				
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCT	YES	PROLINE	4		
CCC	YES				
CCA	YES				
CCG	YES				
		SERINE	0	POLAR NONIONIZABLE (POL)	2
		CYSTEINE	0		
		ASPARAGINE	0		
CAA	YES	GLUTAMINE	2		
CAG	YES				
		TYROSINE	0		
		THREONINE	0		
GAT	YES	ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	4
GAC	YES				
GAA	YES	GLUTAMIC ACID	2		
GAG	YES				
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	6
CGT	YES	ARGININE	4		
CGC	YES				
CGA	YES				
CGG	YES				
CAT	YES	HISTIDINE	2		
CAC	YES				
		STOP CODON	0	STOP SIGNAL (STP)	0
32		10 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 20: 2: 4: 6: 0	

TABLE 50. C/T, N, N

TABLE 30. C, T, A, G					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	13
		ALANINE	0		
		VALINE	0		
TTA	YES	LEUCINE	6		
TTG	YES				
CTT	YES				
CTC	YES				
CTA	YES				
CTG	YES				
		ISOLEUCINE	0		
		METHIONINE	0		
TTT	YES	PHENYLALANINE	2		
TTC	YES				
TGG	YES	TRYPTOPHAN	1		
CCT	YES	PROLINE	4		
CCC	YES				
CCA	YES				
CCG	YES				
TCT	YES	SERINE	4	POLAR NONIONIZABLE (POL)	10
TCC	YES				
TCA	YES				
TCG	YES				
TGT	YES	CYSTEINE	2		
TGC	YES				
		ASPARAGINE	0		
CAA	YES	GLUTAMINE	2		
CAG	YES				
TAT	YES	TYROSINE	2		
TAC	YES				
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	6
CGT	YES	ARGININE	4		
CGC	YES				
CGA	YES				
CGG	YES				
CAT	YES	HISTIDINE	2		
CAC	YES				
TAA	YES	STOP CODON	3	STOP SIGNAL (STP)	3
TAG	YES				
TGA	YES				
TOTAL	32	10 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 13: 10: 0: 6: 3	



TABLE 51. G/T, N, N

1. G/T, N, N					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	4	NONPOLAR (NPL)	17
GGC	YES				
GGA	YES				
GGG	YES				
GCT	YES	ALANINE	4		
GCC	YES				
GCA	YES				
GCG	YES				
GTT	YES	VALINE	4		
GTC	YES				
GTA	YES				
GTG	YES				
TTA	YES	LEUCINE	2		
TTG	YES				
		ISOLEUCINE	0		
		METHIONINE	0		
TTT	YES	PHENYLALANINE	2		
TTC	YES				
TGG	YES	TRYPTOPHAN	1		
		PROLINE	0		
TCT	YES	SERINE	4	POLAR NONIONIZABLE (POL)	8
TCC	YES				
TCA	YES				
TCG	YES				
TGT	YES	CYSTEINE	2		
TGC	YES				
		ASPARAGINE	0		
		GLUTAMINE	0		
TAT	YES	TYROSINE	2		
TAC	YES				
		THREONINE	0		
GAT	YES	ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	4
GAC	YES				
GAA	YES	GLUTAMIC ACID	2		
GAG	YES				
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		ARGININE	0		
		HISTIDINE	0		
TAA	YES	STOP CODON	3	STOP SIGNAL (STP)	3
TAG	YES				
TGA	YES				
32			11 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 17: 8: 4: 0: 3	

TABLE 52. N, A, N

TABLE 52. N, A, N					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	0
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	6
		CYSTEINE	0		
AAT	YES	ASPARAGINE	2		
AAC	YES				
CAA	YES	GLUTAMINE	2		
CAG	YES				
TAT	YES	TYROSINE	2		
TAC	YES				
		THREONINE	0		
GAT	YES	ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	4
GAC	YES				
GAA	YES	GLUTAMIC ACID	2		
GAG	YES				
AAA	YES	LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	4
AAG	YES				
		ARGININE	0		
CAT	YES	HISTIDINE	2		
CAC	YES				
TAA	YES	STOP CODON	2	STOP SIGNAL (STP)	2
TAG	YES				
TOTAL	16	7 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 0: 6: 4: 4: 2	

5

TABLE 53. N, C, N

TABLE 33: A, C, G, U					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	8
GCT	YES	ALANINE	4		
GCC	YES				
GCA	YES				
GCG	YES				
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCT	YES	PROLINE	4		
CCC	YES				
CCA	YES				
CCG	YES				
TCT	YES	SERINE	4	POLAR NONIONIZABLE (POL)	8
TCC	YES				
TCA	YES				
TCG	YES				
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
ACT	YES	THREONINE	4		
ACC	YES				
ACA	YES				
ACG	YES				
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		ARGININE	0		
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL		16	4 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 8: 8: 0: 0: 0	

TABLE 54. N, G, N

TABLE 54. N, G, N					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	4	NONPOLAR (NPL)	5
GGC	YES				
GGA	YES				
GGG	YES				
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
TGG	YES	TRYPTOPHAN	1		
		PROLINE	0		
AGT	YES	SERINE	2	POLAR NONIONIZABLE (POL)	4
AGC	YES				
TGT	YES	CYSTEINE	2		
TGC	YES				
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	6
CGT	YES	ARGININE	6		
CGC	YES				
CGA	YES				
CGG	YES				
AGA	YES				
AGG	YES				
		HISTIDINE	0		
TGA	YES	STOP CODON	1	STOP SIGNAL (STP)	1
TOTAL		16	5 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 5: 4: 0: 6: 1	

TABLE 55. N, T, N

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	16
		ALANINE	0		
GTT	YES	VALINE	4		
GTC	YES				
GTA	YES				
GTG	YES				
TTA	YES	LEUCINE	6		
TTG	YES				
CTT	YES				
CTC	YES				
CTA	YES				
CTG	YES				
ATT	YES	ISOLEUCINE	3		
ATC	YES				
ATA	YES				
ATG	YES	METHIONINE	1		
TTT	YES	PHENYLALANINE	2	POLAR NONIONIZABLE (POL)	0
TTC	YES				
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0		
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		THREONINE	0		
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		ARGININE	0		
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL		16	5 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 16: 0: 0: 0: 0	

TABLE 56. N, A/C, N

CODON		Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
			GLYCINE	0	NONPOLAR (NPL)	8
GCT	YES		ALANINE	4		
GCC	YES					
GCA	YES					
GCG	YES					
			VALINE	0		
			LEUCINE	0		
			ISOLEUCINE	0		
			METHIONINE	0		
			PHENYLALANINE	0		
			TRYPTOPHAN	0		
CCT	YES		PROLINE	4		
CCC	YES					
CCA	YES					
CCG	YES					
TCT	YES		SERINE	4	POLAR NONIONIZABLE (POL)	14
TCC	YES					
TCA	YES					
TCG	YES					
			CYSTEINE	0		
AAT	YES		ASPARAGINE	2		
AAC	YES					
CAA	YES		GLUTAMINE	2		
CAG	YES					
TAT	YES		TYROSINE	2		
TAC	YES					
ACT	YES		THREONINE	4		
ACC	YES					
ACA	YES					
ACG	YES					
GAT	YES		ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	4
GAC	YES					
GAA	YES		GLUTAMIC ACID	2		
GAG	YES					
AAA	YES		LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	4
AAG	YES					
			ARGININE	0		
CAT	YES		HISTIDINE	2		
CAC	YES				STOP SIGNAL (STP)	2
TAA	YES		STOP CODON	2		
TAG	YES					
32		11 Amino Acids Are Represented			NPL: POL: NEG: POS: STP 8: 14: 4: 4: 2	

TABLE 57. N, A/G, N

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	4	NONPOLAR (NPL)	5
GGC	YES				
GGA	YES				
GGG	YES				
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
TGG	YES	TRYPTOPHAN	1		
		PROLINE	0		
AGT	YES	SERINE	2	POLAR NONIONIZABLE (POL)	10
AGC	YES				
TGT	YES	CYSTEINE	2		
TGC	YES				
AAT	YES	ASPARAGINE	2		
AAC	YES				
CAA	YES	GLUTAMINE	2		
CAG	YES				
TAT	YES	TYROSINE	2		
TAC	YES				
		THREONINE	0		
GAT	YES	ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	4
GAC	YES				
GAA	YES	GLUTAMIC ACID	2		
GAG	YES				
AAA	YES	LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	10
AAG	YES				
CGT	YES	ARGININE	6		
CGC	YES				
CGA	YES				
CGG	YES				
AGA	YES				
AGG	YES				
CAT	YES	HISTIDINE	2		
CAC	YES				
TAA	YES	STOP CODON	3	STOP SIGNAL (STP)	3
TAG	YES				
TGA	YES				
32			12 Amino Acids Are Represented	NPL: POL: NEG: POS: STP 5: 10: 4: 10: 3	



TABLE 58. N, A/T, N

CODON		Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
			GLYCINE	0	NONPOLAR (NPL)	16
			ALANINE	0		
GTT	YES	VALINE	VALINE	4		
GTC	YES					
GTA	YES					
GTG	YES					
TTA	YES	LEUCINE	LEUCINE	6		
TTG	YES					
CTT	YES					
CTC	YES					
CTA	YES					
CTG	YES					
ATT	YES	ISOLEUCINE	ISOLEUCINE	3		
ATC	YES					
ATA	YES					
ATG	YES	METHIONINE	METHIONINE	1		
TTT	YES	PHENYLALANINE	PHENYLALANINE	2		
TTC	YES					
			TRYPTOPHAN	0		
			PROLINE	0		
			SERINE	0		
			CYSTEINE	0		
AAT	YES	ASPARAGINE	ASPARAGINE	2	POLAR NONIONIZABLE (POL)	6
AAC	YES					
CAA	YES	GLUTAMINE	GLUTAMINE	2		
CAG	YES					
TAT	YES	TYROSINE	TYROSINE	2		
TAC	YES					
		THREONINE	THREONINE	0		
GAT	YES	ASPARTIC ACID	ASPARTIC ACID	2		
GAC	YES					
GAA	YES	GLUTAMIC ACID	GLUTAMIC ACID	2		
GAG	YES					
AAA	YES	LYSINE	LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	4
AAG	YES					
		ARGININE	ARGININE	0		
CAT	YES	HISTIDINE	HISTIDINE	2		
CAC	YES					
TAA	YES	STOP CODON	STOP CODON	2		
TAG	YES					
32		12 Amino Acids Are Represented			NPL: POL: NEG: POS: STP 16: 6: 4: 4: 2	

TABLE 59. N, C/G, N

TABLE 39. N, C/G, N					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	4	NONPOLAR (NPL)	13
GGC	YES				
GGA	YES				
GGG	YES				
GCT	YES	ALANINE	4		
GCC	YES				
GCA	YES				
GCG	YES				
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
TGG	YES	TRYPTOPHAN	1		
CCT	YES	PROLINE	4		
CCC	YES				
CCA	YES				
CCG	YES				
TCT	YES	SERINE	6	POLAR NONIONIZABLE (POL)	12
TCC	YES				
TCA	YES				
TCG	YES				
AGT	YES				
AGC	YES				
TGT	YES	CYSTEINE	2		
TGC	YES				
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
ACT	YES	THREONINE	4		
ACC	YES				
ACA	YES				
ACG	YES				
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	6
CGT	YES	ARGININE	6		
CGC	YES				
CGA	YES				
CGG	YES				
AGA	YES				
AGG	YES				
		HISTIDINE	0		
TGA	YES	STOP CODON	1	STOP SIGNAL (STP)	1
TOTAL		32	8 Amino Acids Are Represented	NPL: POL: NEG: POS: STP 13: 12: 0: 6: 1	

TABLE 60. N, C/T, N

TABLE 60. C/T, N					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	24
GCT	YES	ALANINE	4		
GCC	YES				
GCA	YES				
GCG	YES				
GTT	YES	VALINE	4		
GTC	YES				
GTA	YES				
GTG	YES				
TTA	YES	LEUCINE	6		
TTG	YES				
CTT	YES				
CTC	YES				
CTA	YES				
CTG	YES				
ATT	YES	ISOLEUCINE	3		
ATC	YES				
ATA	YES				
ATG	YES	METHIONINE	1		
TTT	YES	PHENYLALANINE	2		
TTC	YES				
		TRYPTOPHAN	0		
CCT	YES	PROLINE	4		
CCC	YES				
CCA	YES				
CCG	YES				
TCT	YES	SERINE	4	POLAR NONIONIZABLE (POL)	8
TCC	YES				
TCA	YES				
TCG	YES				
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
ACT	YES	THREONINE	4		
ACC	YES				
ACA	YES			IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
ACG	YES				
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		LYSINE	0		
		ARGININE	0		
		HISTIDINE	0	STOP SIGNAL (STP)	0
		STOP CODON	0		
TOTAL	32	9 Amino Acids Are Represented		NPL: POL: NEG: POS: STP 24: 8: 0: 0: 0	

TABLE 61. N, G/T, N

N, G/T, N					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	4	NONPOLAR (NPL)	21
GGC	YES				
GGA	YES				
GGG	YES				
		ALANINE	0		
GTT	YES	VALINE	4		
GTC	YES				
GTA	YES				
GTG	YES				
TTA	YES	LEUCINE	6		
TTG	YES				
CTT	YES				
CTC	YES				
CTA	YES				
CTG	YES				
ATT	YES	ISOLEUCINE	3		
ATC	YES				
ATA	YES				
ATG	YES	METHIONINE	1		
TTT	YES	PHENYLALANINE	2		
TTC	YES				
TGG	YES	TRYPTOPHAN	1		
		PROLINE	0		
AGT	YES	SERINE	2	POLAR NONIONIZABLE (POL)	4
AGC	YES				
TGT	YES	CYSTEINE	2		
TGC	YES				
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	6
CGT	YES	ARGININE	6		
CGC	YES				
CGA	YES				
CGG	YES				
AGA	YES				
AGG	YES				
		HISTIDINE	0		
TGA	YES	STOP CODON	1	STOP SIGNAL (STP)	1
32		10 Amino Acids Are Represented		NPL: POL: NEG: POS: STP 21: 4: 0: 6: 1	

TABLE 62. N, A/C/G, N

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	4	NONPOLAR (NPL)	13
GGC	YES				
GGA	YES				
GGG	YES				
GCT	YES	ALANINE	4		
GCC	YES				
GCA	YES				
GCG	YES				
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
TGG	YES	TRYPTOPHAN	1	POLAR NONIONIZABLE (POL)	18
CCT	YES	PROLINE	4		
CCC	YES				
CCA	YES				
CCG	YES				
TCT	YES	SERINE	6		
TCC	YES				
TCA	YES				
TCG	YES				
AGT	YES				
AGC	YES				
TGT	YES	CYSTEINE	2		
TGC	YES				
AAT	YES	ASPARAGINE	2		
AAC	YES				
CAA	YES	GLUTAMINE	2		
CAG	YES				
TAT	YES	TYROSINE	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	4
TAC	YES				
ACT	YES	THREONINE	4		
ACC	YES				
ACA	YES			IONIZABLE: BASIC POSITIVE CHARGE (POS)	10
ACG	YES				
GAT	YES	ASPARTIC ACID	2		
GAC	YES				
GAA	YES	GLUTAMIC ACID	2		
GAG	YES				
AAA	YES	LYSINE	2		
AAG	YES				
CGT	YES	ARGININE	6	STOP SIGNAL (STP)	3
CGC	YES				
CGA	YES				
CGG	YES				
AGA	YES				
AGG	YES				
CAT	YES	HISTIDINE	2		
CAC	YES			STOP SIGNAL (STP)	3
TAA	YES	STOP CODON	3		
TAG	YES				
TGA	YES				
TOTAL		48	15 Amino Acids Are Represented	NPL: POL: NEG: POS: STP 13: 18: 4: 10: 3	



TABLE 63. N, A/C/T, N

N, A/C/I, N					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	24
GCT	YES	ALANINE	4		
GCC	YES				
GCA	YES				
GCG	YES				
GTT	YES	VALINE	4		
GTC	YES				
GTA	YES				
GTG	YES				
TTA	YES	LEUCINE	6		
TTG	YES				
CTT	YES				
CTC	YES				
CTA	YES				
CTG	YES				
ATT	YES	ISOLEUCINE	3		
ATC	YES				
ATA	YES				
ATG	YES	METHIONINE	1		
TTT	YES	PHENYLALANINE	2		
TTC	YES				
		TRYPTOPHAN	0		
CCT	YES	PROLINE	4		
CCC	YES				
CCA	YES				
CCG	YES				
TCT	YES	SERINE	4	POLAR NONIONIZABLE (POL)	14
TCC	YES				
TCA	YES				
TCG	YES				
		CYSTEINE	0		
AAT	YES	ASPARAGINE	2		
AAC	YES				
CAA	YES	GLUTAMINE	2		
CAG	YES				
TAT	YES	TYROSINE	2		
TAC	YES				
ACT	YES	THREONINE	4		
ACC	YES				
ACA	YES				
ACG	YES				
GAT	YES	ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	4
GAC	YES				
GAA	YES	GLUTAMIC ACID	2		
GAG	YES				
AAA	YES	LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	4
AAG	YES				
		ARGININE	0		
CAT	YES	HISTIDINE	2		
CAC	YES				
TAA	YES	STOP CODON	2	STOP SIGNAL (STP)	2
TAG	YES				
48		16 Amino Acids Are Represented		NPL: POL: NEG: POS: STP 24: 14: 4: 4: 2	